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CHAPTER NINE: SAMPLING

Sampling is perhaps the most important step in assuring that good quality aggregates are being used on INDOT construction projects. Since a sample is just a small portion of the total material, the importance that the sample be representative of the material being delivered cannot be overemphasized. Any test performed on the sample, regardless of how carefully and accurately performed, is worthless unless the sample is truly representative of the material offered for use on the project.

SAFETY

The sampling of materials can expose the technician to machinery, moving belts, large stockpiles, and other potential dangers. Proper safety practices are always the first concern. Know your company safety rules and follow them at all times. When you are not sure or feel unsafe, stop and seek your supervisor's instructions.

SAMPLE REFERENCES

A representative sample may be obtained by following the standard procedures detailed in **AASHTO T2,** or **ITM 207**, A Method of Sampling Stockpile Aggregate.

SIZES OF ORIGINAL SAMPLES

The key to any sample program is to obtain a representative sample. A standard sampling method must be followed to obtain uniform samples.

The following is a list of recommended minimum sizes of composite samples to be used as a guide when collecting samples.

MATERIAL	SAMPLE SIZE
No. 1 coarse aggregate	385 lb
No. 2 coarse aggregate	220 lb
No. 5 coarse aggregate	110 lb
No. 8 coarse aggregate	55 lb
No. 9 coarse aggregate	35 lb
No. 11 & No. 12 coarse aggregate	25 lb
No. 43 coarse aggregate	110 lb
No. 53 coarse aggregate	135 lb
No. 73 coarse aggregate	80 lb
2 in. Structure Backfill	245 lb
1½ in. Structure Backfill	190 lb
1 in. Structure Backfill	135 lb
½ in. Structure Backfill	60 lb
All sands No. 4 & No. 30 B Borrow	25 lb

The weight of the sample depends on the maximum particle size of the material being inspected. As a rule, a larger top size material requires a larger sample. A 25 lb. sample of No.2 coarse aggregate would not be as representative of that material as a 25 lb. sample of natural sand.

TWO IMPORTANT DEFINITIONS TO REMEMBER

Top Size or Maximum Particle Size -- The sieve on which 100 percent of the material will pass.

Nominal Maximum Particle Size – Smallest sieve opening through which the entire amount of the aggregate is permitted to pass.

SAMPLE TYPES

The technician should realize there are different types of samples. The most common sample is a stockpile sample, which is normally the method of load-out sampling under CAPP.

Some samples need to be taken in the processing operation to assure that the final product will be within control limits. These samples are referred to as production samples. The gradation at this point may not be the same as a load-out sample at some facilities.

Occasionally, an investigative sample should be obtained when looking for a very specific feature, such as a certain sieve, oversized material, etc. These tests may consist of many shortcuts and should only be used as a quick comfort level check.

Every source can have other types of samples which are unique to their operation.

METHODS OF SAMPLING

Because of the various sampling locations and the availability of equipment, there are several methods of taking aggregate samples. Uniformity of obtaining the sample cannot be emphasized enough, since it eliminates one variable in test results. The technician must remember that safety comes first.

PRODUCTION SAMPLING

Bin Sample

Sampling the top of the bin is an extremely dangerous as well as a difficult, if not impossible, method to obtain a representative sample. For this reason, this method of sampling is undesirable.

Discharge Sampling of Bins or Belts

Bin samples can be taken at the discharge chute. In these cases a number of small samples should be taken at short intervals and combined to make the total sample. Each of these samples must include the entire cross section of the flow of material from the chute or belt.

Continuity of operation normally will not allow the technician to control the rate of flow from the discharge chute. All methods, including manual methods, should be detailed in the Quality Control Plan and include proper safety practices.

[NOTE: A mechanical diversion or slide chute system is the quickest, safest, and most accurate system; unfortunately very few mechanical systems exist.]

Belt Sampling

Belt sampling material consists of taking samples of materials directly from conveyor belts. The proper procedure is to:

1) Make sure that the belt is carrying a normal load of material that is not segregated;

2) Have the plant operator stop the belt and use proper lock out procedures;

3) Take a complete cross section of the material, being careful to include all the material on the belt and only the material in the section. A template is recommended, especially on steeply inclined belts. Remove most of the sample with a scoop or shovel and the remainder with a brush; and

4) Take as many complete cross sections as necessary to obtain a sample that meets the minimum sample size.

LOAD-OUT SAMPLING

Coarse Aggregate Stockpiles

Coarse aggregates are recommended to be sampled using **ITM 207**.

Fine Aggregate Stockpiles

Fine aggregate samples normally are obtained in the same method as coarse aggregate samples, except a fire shovel or sampling tube is used to collect the material.

SAMPLING DIRECTLY FROM TRUCKS, RAIL CARS, OR BARGES

Direct sampling from trucks, rail cars, or barges is not recommended. There are a number of factors that can influence the gradation of the material, such as segregation or particle breakdown during loading, transporting, and unloading. Therefore, material being shipped by cars or barges should be sampled at the point of delivery. Materials being shipped by trucks for local delivery points also should be sampled at the point of delivery.

REDUCING A SAMPLE TO TEST SIZE

The total sample (production or load-out) must be reduced to a sample size that can be quickly tested. Time will not allow the technician to run the total sample. The key to sample reduction is to ensure that the sample remains representative of the material in the stockpile. This practice is commonly referred to as splitting a sample. There are four different methods to reduce a sample to the proper test size.

1) Mechanical Splitter is the most accepted method of reducing to test size all coarse aggregate material smaller than gradation size No.1, except highly moistened Compacted Aggregate.

2) Sand Splitter is the accepted method of reducing fine aggregate or the minus No. 4 material from compacted aggregate samples that is drier than the saturated-surface-dry condition. As a quick check to determine this, if the material retains its shape when molded in the hand, it is considered wetter than saturated-surface-dry.

3) Miniature Stockpile is the method used for fine aggregate that has free moisture on the particle surfaces.

4) Quartering is the method that is used for highly moistened Compacted Aggregate or when a mechanical splitter is not available.

MECHANICAL SPLITTER

The Mechanical Splitter separates the sample into halves as the material passes through the spaces between the bars in the splitter. The same number of each particle size will go into each half of the sample, thus keeping the reduced sample representative of the total collected sample.

In using the Mechanical Splitter, adjust the splitter bars so that the bar opening is approximately twice the maximum particle size of the material to be split. A No.5 aggregate has a maximum particle size of 1½ in. Therefore, the recommended bar opening should be 3 in. or 6 bars wide (each bar is approximately 1/2 in.). INDOT allows the bar opening at 3 in. (6 bars) for all coarse aggregate No. 5 or smaller. The splitter must be level to ensure that each half of the split is approximately the same size; within approximately 10 percent of each other by weight.

The splitting procedure is as follows:

1) Properly place the pans under the splitter in such a way that all of the particles diverting in both directions will be caught;

2) Pour the sample evenly into the hopper;

3) Open the hopper fully and allow the material to free fall through the splitter;

4) If wet particles stick inside the splitter, gently tap the splitter with a rubber hammer to loosen them;

5) To ensure that the sample has not been segregated during sampling, place both halves of the sample back into the hopper and repeat the splitting operation; and

6) After the second splitting, the two receiving pans will contain approximately the same amount of material. Only one pan is placed back into the hopper and the splitting procedure repeated until a sample of the desired size is obtained. Skillful manipulation of the splitter will allow a sample of nearly any size to be made that is still representative of the material in the stockpile.

SAND SPLITTER

The sand splitter is a small version of the Mechanical Splitter except that the openings are fixed and there are no hopper doors.

The splitting procedure is as follows:

1) Place the pans under the splitter to catch all of the particles;

2) Slowly pour the dry sample into the splitter from the side (never from the end or corner);

3) Recombine the samples and split the sample a second time to eliminate any segregation; and

4) Reduce the sample to proper size by additional splitting of the material in one of the pans.

MINIATURE STOCKPILE

This method is used for reducing all samples of fine aggregates when the material is in a damp or moist condition. If the sample to be split is dry, then the material must be moistened before using this method.

The splitting procedure is as follows:

1) Place the original sample on a clean, dry plate or other hard, smooth, non-absorptive surface;

2) Using a trowel or other suitable tool, thoroughly mix the material to remove any segregation;

3) Shape the material into a conical pile; and

4) With a spoon or small trowel, randomly take at least five small portions of material around the pile and one-third way up the cone until the required test sample is obtained.

QUARTERING

Quartering is a non-mechanical method of reducing a sample. This is the best method of reducing highly moistened Compacted Aggregate or when a mechanical splitter is not available.

The quartering procedure is as follows:

1) Pour the sample in a conical pile in the center of a clean, dry, steel plate or other hard, smooth, non-absorptive surface;

2) Using a large trowel, shovel, or other suitable tool, thoroughly mix the material and reshape the sample into a conical pile;

3) Uniformly flatten the pile until the height is approximately equal to one-sixth the diameter;

4) With a large trowel or other suitable tool, divide the sample in half by vertically passing the tool through the center of the pile. In a similar manner divide each of these halves into two parts, thus quartering the sample; and

5) Combine diagonally opposite quarters of the material into two samples. Store one of these two halves. If the remaining material still weighs too much, repeat the entire quartering process until the proper test sample size is obtained.

SIZE OF TEST SAMPLE (AFTER SPLITTING)

The original sample must be reduced to a test sample size which falls within the minimum and maximum weight of the following table.

WEIGHT OF TEST SAMPLE

AGGREGATE SIZE	MINIMUM	MAXIMUM
No.2	11,300 g	---
No.5,	6,000 g	8,000 g
No. 8	6,000 g	8,000 g
No. 9	4,000 g	6,000 g
No. 11	2,000 g	---
No. 12	1,000 g	--
No.43	6,000 g	8,000 g
No.53	6,000 g	8,000 g
No.73	6,000 g	8,000 g
No.91	6,000 g	8,000 g
B Borrow	4,000 g	6,000 g
Structure Backfill: 1/2 in., 1 in., 1½ in. & 2 in.	4,000 g	6,000 g
Structure Backfill: No. 4 & No. 30	300 g	---
Fine Aggregate	300 g	---